

The planetary materials database

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The web pages of the RRUFF project (<http://rruff.info/>) [1] have been an essential tool for the identification and further characterization of minerals. This open database, which receives more than 80,000 visits per week from geologists, mineralogists and the general public worldwide, includes X-ray diffraction (XRD), Raman, infrared (IR) and electron microprobe data of more than 4,000 mineral samples. The experience acquired from the development and maintenance of the RRUFF project has motivated the creation of a new and more interactive database of properties and descriptive measurements of terrestrial planetary analog materials, the *Planetary Materials Database* (PMD). Terrestrial analog data are used by the broader Space Science/Astrobiology community to understand planetary geologic processes, to interpret returned data from present and past missions and to evaluate future mission and instrument concepts prior to their selection for flight. The PMD fills an existing need to archive data obtained in terrestrial laboratories using a variety of instrumental techniques and to make them available in a useful form to the worldwide science community. The PMD will be used to archive and access this data, as well as to provide reference patterns, spectra and other information used by the Space Science and Astrobiology community.

Although the RRUFF project provided the initial inspiration for the PMD, RRUFF was built with a rigid software structure that prevented the addition of new features without extensive reprogramming. The PMD software was developed in part to overcome this limitation. The PMD software platform will be useful for many if not most types of scientific data, allowing database customization according to the particular needs of the users. The database structure was created and is maintained by the University of Arizona. Sample data will be first uploaded from the laboratories who initiated the PMD archive project (University of Arizona, NASA-Ames and Indiana University) and which have extensive databases and existing instruments for on-going data acquisition. Additional data will be uploaded as they are made available from other institutions and research teams.

PMD will be made available to other database developers, and is intended to be a universally accessible, downloadable and citable database, providing measured diffraction patterns, spectra, chemistry, metadata, etc., suitable for use by the Space Science community and the public in general. In follow-on work, we will equip the PMD with interactive web applications for the quantitative analysis of mineralogical and geochemical data.

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[1] Downs R.T. (2006). 19th General Meeting of the International Mineralogical Association. O03-13.

Raman spectra of coexisting graphite and feldspar crystals from the Morasko meteorite

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The Morasko meteorite, found in 1914 within an area located north of Poznań (central-west Poland), is classified as an IAB-MG octahedrite [1]. Its troilite-graphite nodules contain alkali feldspar, pyroxene, and numerous accessory minerals. Feldspar crystals, although ternary, are of almost pure sodium ($Ab_{95.75}An_{4.2}Or_{0.05}$) composition. Plagioclase is a minor phase in the nodules and up to 0.2 mm in size. It fills empty spaces in troilite-graphite matrix forming a complex mosaic, which resembles intergrowths of several minerals. Some albite crystals show potassium-rich ($Or_{96.8}Ab_{3.0}An_{0.2}$) antiperthitic texture. Many of them are strongly enriched in iron (up to 2.15 wt %). The iron-rich domains also demonstrate significant enrichment in trace elements, primarily transition elements. This may indicate that growing feldspar crystals incorporated numerous tiny inclusions. The main phase coexisting with feldspar is graphite. Raman spectra from feldspar and accompanying graphite have been collected to study their structure and phase interrelationship. No area examined by Raman is mono-mineralic and inclusion-free. Raman microspectroscopy allows detailed analysis of chemical composition and distribution of selected compounds in the sample. The collected spectra are dominated by graphite. In this study G and D band analysis has been used to examine crystallinity of the Morasko meteorite. The D band ($\sim 1348\text{ cm}^{-1}$) gives information about disordered/amorphous carbon (A_{1g} symmetry). The G band ($\sim 1580\text{ cm}^{-1}$) is an indication of presence of monocrystalline graphite (E_{2g} symmetry). In the investigated sample the G band has been observed. It implicates the presence of graphite as the main component of the Morasko iron nodules. The D band was also observed. Its intensity is dependent on the degree of disorder in graphite symmetry. Appearance of feldspar seems to increase disorder in graphite symmetry (raised intensity of the D band). Additionally, Raman results provide information about distribution of minerals such as albite ($285, 476, 513\text{ cm}^{-1}$) and pyroxene ($339, 663, 683, 1013\text{ cm}^{-1}$).

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[1] Karwowski Ł., Kryza R., Muszyński A., Piłski A.S., (2012). Outline of the mineralogy of the Morasko meteorite. In: Muszyński *et al.* (eds.): Morasko - the largest meteorite shower in Europe. Bogucki Wydawnictwo Naukowe. Poznań.